geographically non-random distribution and is more likely to occur where *W. lepida* is present than when it is not. We found that the fitness of *D. pulchra* increases with decreasing distance from *W. lepida* and that, controlling for direction and distance from *W. lepida*, there was an overall decrease in pollination with increasing distance from *W. lepida*. These results highlight the dependency of a Batesian mimic on its model and suggest that fitness and population expansion of *D. pulchra* is constrained by its reliance on *W. lepida*.

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The effects of range margin proximity and life-history on dispersal ability in southern African Asteraceae

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As future climatic conditions change, dispersal may enable species to track their shifting climatic envelopes. Therefore it is of particular interest to investigate populations that occur on range margins, because individuals in these populations will make the first 'advances' during a climate-forced migration. However, it will also be these populations that could be most sensitive to severe climatic changes and range contractions. In addition, several studies suggest that the dispersal ability of a species may be linked to its life-history traits, and therefore annual and perennial species may experience different marginal effects. Here we investigate dispersability of southern African Asteraceae in populations at their range margins in comparison to populations at the centre of distribution ranges. We also compare the capacity for dispersal between annual species and their closely related perennial counterparts. We collected mature fruits from numerous Asteraceae species across their distribution ranges in the Greater Cape Floristic Region. Dispersal traits (wing load and fall time) were measured for representative marginal and central populations. Preliminary results suggest significant variation in dispersal capacity among populations within species across their geographic ranges. Geographic patterns of variation in dispersal traits are not consistent between species, which suggests that responses to climate-forced range shifts may differ between taxa. Life-history strategies also have variable effects on dispersal ability within genera. In general, perennials have intermediate to high dispersal abilities compared to annuals. The results of this study will be especially significant in the face of range loss induced by climate change predicted for both generalist species with large geographic ranges (such as many Asteraceae) and narrow-range endemics in the Greater Cape Floristic Region.

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Self-pollination and pollen limitation in the Cape Flora

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Inadequate cross pollination has been invoked to explain pollinator shifts of plants, and hence pollinator driven speciation, in the Cape Flora. However, limitation of fecundity by pollen receipt (pollen limitation) has been poorly documented in the Cape Flora. Ability to self-pollinate, which reduces dependence on pollinators, is also poorly known in this region. We document the frequencies of pollen limitation and ability to self-fertilise in the Cape Flora from our own community level surveys and from the literature, in order to evaluate support for the idea that unusually high pollen limitation is a contributing factor to the high plant diversity of the Cape.

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Sexual mimicry in sympatric orchid species promotes outcrossing, multiple paternity and reproductive isolation

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Most flowering plants engage animals to carry out the essential service of pollination. The majority of these plants have evolved flowers that advertise rewards for this service via visual and chemical cues such as petals and scent. There are however a number of species whose false advertisements draw pollinators to reward-less flowers. Among them are the sexually deceptive orchids which employ a precise chemical mimicry of female wasp sex pheromones to attract male wasps for pollination. This multidisciplinary study examines the consequences of sexual deception in the mating patterns of two sympatric Australian orchids. We show through behavioural and population genetic analysis that the chemical mimicry crucial to sexual deception is also responsible for almost exclusive pre-pollination reproductive isolation and potentially even speciation. We also report paternity and mating system analysis that demonstrates that sexual deception results in near exclusive out-crossing despite clonality as well as multiple paternity-a rarity for orchids. In addition, innovative studies of wasp behaviour provide another line of evidence to show that this pollination strategy is a superbly adaptive solution to the problem flowers face of simulta-neously attracting pollinators and persuading them to leave quickly.

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Potential for speciation through hybridization in Rhodohypoxis a Drakensberg near-endemic

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Hybridisation is not uncommon in nature and may have many evolutionary effects including greater genetic diversity and potential for adaptation to new environments. The ability of hybrids to remain distinct or in distinct ecological zones suggests that speciation may be an outcome. The species of *Rhodohypoxis* (Hypoxidaceae), a Drakensberg near-endemic, readily hybridise with each other and with certain Hypoxis species. To answer the question as to whether there is potential for speciation via hybridization in *Rhodohypoxis*, a study comparing the success rates of cross pollination within and between species was set up. Two grassland species, *R. milloides*, growing in a marsh, and *R. baurii* var. *platypetala*, occurring on an adjacent dry, rocky outcrop, were investigated on Mt. Mawahqua near Underberg, KwaZulu-Natal, where morphological intermediates were noted to occur. Pollinator exclusion bags were used on buds that underwent one of the following treatments: manual cross-pollination, emasculation, selfing or combinations thereof. Results indicate that there is no difference in seed set within and between species. The high population density and shorter, more intense

flowering season promoted greater seed set in *R. milloides* than in the more dispersed *R. baurii* var. *platypetala*. Neither selfing nor apomixis appear to be operating in these species, even though little pollinator activity was observed. Thus, viable seed production across these species' boundaries followed by vegetative reproduction enable the persistence of hybrids, which over time could become species.

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Smoke-derived compounds with germination activity: Towards understanding the mode of action by investigating structure-activity relationships of synthetic analogues

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Burning vegetation produces smoke that contains highly active compounds known to promote seed germination in many species. A butenolide compound, 3-methyl-2*H*-furo[2,3-*c*]pyran-2-one (karrikinolide; KAR_1), is one such compound that can promote germination at concentrations as low as 10^{-10} M. Conversely, a structurally-related butenolide, 3,4,5-trimethylfuran-2(5*H*)-one (trimethylbutenolide; TMB), also present in smoke, has been shown to inhibit germination and reduce the promotory effect of KAR_1 in a test system using lettuce seeds (achenes of *Lactuca sativa* L. cv. 'Grand Rapids'). Little is known, however, regarding the mechanism by which TMB inhibits germination or interacts with KAR_1. Thus, several synthetic derivatives of TMB were prepared to investigate the effect of related compounds on the germination of Grand Rapids lettuce seeds. A range of concentrations (from 10^{-3} M to 10^{-6} M) of these analogues of TMB were tested in combination with 10^{-8} M KAR_1 to determine the relative activity of the synthesised compounds. Of the 11 analogues tested, only two compounds were found to reduce the promotory effect of 10^{-8} M KAR_1 in a similar manner as observed with TMB, with activity from 10^{-3} M to 10^{-5} M. Four of the compounds were also found to have inhibitory activity at 10^{-3} M and 10^{-4} M. Since some of the synthetic compounds have exhibited inhibitory activity similar to TMB, this may be useful for the design of novel compounds with better activity.

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Seed germination of the highly utilized medicinal plant - *Coleonema album*

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Coleonema album is a South African green treasure endemic to the Cape region. Immunat, a tincture prepared from this plant is marketed commercially. Medicinal plant gatherers are on the lookout for this plant due to its high demand and market price. It is ranked among the highly utilized medicinal plants at present. Several natural product companies in South Africa are now exporting *Coleonema album* oil. Its showy beautiful white flowers make it a valuable ornamental plant. There is no accredited germination protocol available for this medicinal and ornamental plant. In this study, the chemical and environmental conditions required for optimum seed germination were studied. The results of this study have shown that low temperatures (10 and 15 °C), continuous darkness and temperature shifts (high to low) favor seed germination. High temperatures: 20, 25, 30 and 35 °C completely inhibit seed germination. A pH 6 buffer, (ammonium nitrate and sodium chloride solutions of 10^{-2} M) significantly improved seed germination at 15 °C under continuous dark conditions. The result of this study reflects a link between *Coleonema album* seed germination requirements and its geographical distribution. *Coleonema album* seeds exhibit physiological dormancy. The results of this study will be useful as a guide for mass cultivation of this aromatic and medicinal plant. It will also provide an opportunity for propagation of *Coleonema album* in other parts of the country.

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Desiccation stress and the *Xerophyta* metabolome

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Resurrection plants are unique in the ability to survive near complete water loss in vegetative tissues without loss of viability. In order to do so, they employ multifaceted strategies which include structural adaptations, antioxidant and photoprotective mechanisms, and the accumulation of proteins and metabolites that stabilise macromolecules. A full understanding of the phenomenon of vegetative desiccation tolerance will require a systems view of these adaptations at the levels of the genome, the control of gene expression, and the control of metabolic pathways. In this presentation, we report a high-throughput metabolomic analysis of the changes that occur in vegetative tissues of the resurrection plant *Xerophyta humilis* during dehydration We have used a combination of chromatography, mass spectrometry and nuclear magnetic resonance, to discern numerous primary and secondary metabolites. Multivariate statistics have revealed a subset of metabolites that are significantly up- or down-regulated in response to water deficit stress. Mapping the identified metabolites onto known biochemical pathways lets us suggest possible regulatory schemes in the stress response, inviting deeper investigation in future.

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Determination of changes in membrane lipid composition during rehydration and dehydration of the resurrection plant *Xerophyta humilis* using multiple reaction monitoring mass spectrometry

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Plants whose fully differentiated tissues are able to withstand desiccation to air-dryness for prolonged periods of time and able to resume their full metabolic functioning in existing tissues upon rewatering are termed resurrection plants. Considerable research has been conducted on the structural, physiological, biochemical and molecular changes accompanying dehydration and recovery of a number of resurrection plants in order to ascertain the protective